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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/578,155	05/04/2006	Harry Vig	037-03US1	8796

53590 7590 11/04/2008

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EXAMINER	
VAUGHAN, MICHAEL R	

ART UNIT	PAPER NUMBER
2431	

MAIL DATE	DELIVERY MODE
11/04/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/578,155	VIG ET AL.	
	Examiner	Art Unit	
	MICHAEL R. VAUGHAN	2431	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☒ Claim(s) *1,6,12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 May 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/4/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The instant application having Application No. 10/578,155 filed on 5/04/06 is presented for examination by the examiner.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the subject matter of claims 4 and 5 must be shown or the feature(s) canceled from the claim(s). Specifically, the varying of a detector gate pulse width W over a range of pulse widths RW1 to establish an optimal detector gate pulse width Wmax. The second range RW2 should also be included. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New

Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 1, 6, and 12 are objected to because of the following informalities:

As per claims 1 and 6, the phrase "the detector gating pulse" lacks antecedent basis.

As per claim 12, the end of the claim is missing a period.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:
Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 6, 11, and 12 are rejected under 35 U.S.C. 101 as directed to non-statutory subject matter of software, per se. The claim lacks the necessary physical articles or objects to constitute a machine or manufacture within the meaning of 35 U.S.C. 101. It is clearly not a series of steps or acts to be a process nor is it a combination of chemical compounds to be a composition of matter. As such, they fail to fall within a statutory category. It is at best, function descriptive material per se. The

language of the claims fails to recite the "computer-readable medium causing a computer to execute instructions" terminology that the courts have insisted upon.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1, 6, and 7 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 5, and 7 of copending Application No.10/589,419. Although the conflicting claims are not identical, they are not patentably distinct from each other because the method of calibrating a quantum key distribution system is common to both applications.

Instant Application **10/578,155**	Co-pending Application **10/589,419**

Claim 1	Claim 1
A method of **auto-calibrating a single-photon detector** arranged to detect weak photon pulses in a **quantum key distribution (QKD) system**, comprising:	A method of **auto-calibrating a quantum key distribution** (QKD) system having two encoding stations, a laser and a **single-photon detector** (SPD) unit, comprising:
a) performing a detector gate scan by sending a detector gate **pulse to the single-photon detector and varying an arrival time T of the detector gating pulse over a first select range R1 to determine an optimal arrival time TMAX that corresponds to a maximum number of photon counts** NMAX from the single-photon detector; and	a) performing a laser gate scan by sending a laser gating **signal to the laser and varying an arrival time T of the laser gating signal over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a first optimum number of photon counts** from the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations; and
b) performing detector gate **dithering by varying the arrival time T over a second select range R2 surrounding TMAX to maintain the photon count at a maximum value.**	b) performing laser gate **dithering by varying the arrival time T over a second select range R2 surrounding TMAX to maintain either the first optimum number** of photon counts or a second optimum number of photon counts count as optimum.

As highlighted above both claims are directed to the auto-calibration of a QKD system. The main difference is the wording. The instant application sending a pulse and the co-pending application uses the word signal. A signal and pulse are obviously synonymous in the context of the invention. Both claims perform the two parts analysis of photon counts over a R1 and R2 range to achieve a maximum value. Thus there is no patentable difference between the two claims. Similarly claims 6 and 7 share these same commons features.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As per claim 7, essential method steps are omitted. The claim is directed to a method of exchanging keys. However there are no steps involving the exchange of keys. The claim is directed to auto-calibrating a QKD system but none of the limitations involve a key of any kind. The dependent claims do not rectify this problem. Appropriate correction is required.

Claims 12 and 12* rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. There are two claim 12's. The first being an independent claim which Examiner will treat as claim 12. The second claim listed as 12 is a dependent claim to 11 but is likely dependent on the first claim 12, as it depends on a method and claim 11 is a computer-readable medium. Examiner is treating the dependent claim 12 as though it depends on the independent claim 12.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-13 are rejected under 35 U.S.C. 102(b) as being anticipated by "An Autocompensating Fiber-Optic Quantum Cryptography System Based on Polarization Splitting of Light" by Bethune and Risk, hereinafter Bethune.

As per claim 1, Bethune teaches a method of a single-photon detector arranged to detect weak photon pulses in a quantum key distribution (QKD) system (Fig.1), comprising:

a) performing a laser gate scan by sending a detector gate pulse to the single-photon

detector and varying an arrival time T [bias pulse delay] of the detector gating pulse over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a maximum number of photon counts from the SPD (pg.343); and

b) performing detector gate dithering by varying the arrival time T over a second select range R2 [different range by adjusting the phase] surrounding TMAX to maintain the photon count at a maximum value (Fig. 3a and pg. 343).

As per claim 2, Bethune teaches terminating the detector gate dithering and performing another detector gate scan (pg. 343).

As per claim 3, Bethune teaches the QKD system includes a programmable controller and a computer readable medium, and wherein the method is embodied in the computer readable medium such that the controller is capable of directing the QKD system to carry out acts a) through b) (computers in Fig. 1).

As per claim 4, Bethune teaches performing the detector gate scan includes varying a detector gate pulse width W over a range of pulse widths RW1 to establish an optimal detector gate pulse width WMAX (Fig. 3a and pg. 343).

As per claim 5, Bethune teaches performing detector gate dithering includes varying the detector gate pulse width W over a range of pulse widths RW2 RW1 to maintain an optimal pulse width (Fig. 3a and pg. 343).

As per claim 6, Bethune teaches a computer-readable medium to perform the method of a single-photon detector arranged to detect weak photon pulses in a quantum key distribution (QKD) system (Fig.1), comprising:

a) performing a laser gate scan by sending a detector gate pulse to the single-photon

detector and varying an arrival time T [bias pulse delay] of the detector gating pulse over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a maximum number of photon counts from the SPD (Fig. 3a and pg. 343); and b) performing detector gate dithering by varying the arrival time T over a second select range R2 [different range by adjusting the phase] surrounding TMAX to maintain the photon count at a maximum value (Fig. 3a and pg. 343).

As per claim 7, Bethune teaches a method of exchanging a key in a quantum key distribution (QKD) system having a single-photon detector operably coupled to a controller, comprising:

sending weak photon pulses between encoding stations in the QKD system (pg. 340); performing a first detector gate scan by sending a detector gate pulse from the controller to the detector over a range of detector gate pulse arrival times T to establish a first optimal arrival time TMAX corresponding to a first maximum number of photon counts NMAX from the detector (Fig. 3a and pg. 343);

terminating the first detector gate scan when the first TMAX is established [multiple tests on different delays]; and

performing a first detector gate dither altering the arrival time T over a range of arrival times R2 about the first TMAX to maintain either the maximum number of photon counts NMAX or a different maximum number of photon counts N'MAX over the range R2 (pg. 343).

As per claim 8, Bethune teaches performing the detector gate dither results in a new optimal arrival time T'MAX (pg. 343, second column).

As per claim 9, Bethune teaches terminating the performing of a detector gate dither;

performing a second detector gate scan;

terminating the second detector gate scan; and

performing a second detector gate dither [second phase] (pg. 343).

As per claim 10, Bethune teaches terminating and repeating the first detector gate dither periodically so as to perform a series of detector gate dithers (pg. 343 and Fig. 3a).

As per claim 11, Bethune teaches a computer-readable medium having instructions embodied therein to direct a computer in a quantum key distribution (QKD) system to perform the following method of performing auto-calibration of a single-photon detector arranged to detect photons in the QKD system (Fig. 1):

sending weak photon pulses between encoding stations in the QKD system (pg. 340);

performing a first detector gate scan by sending a detector gate pulse from the controller to the detector over a range of detector gate pulse arrival times T to establish a first optimal arrival time TMAX corresponding to a first maximum number of photon counts NMAX from the detector (Fig. 3a and pg. 343);

terminating the first detector gate scan when the first TMAX is established; and

performing a first detector gate dither by the controller altering the arrival time T over a range of arrival times R2 about the first TMAX to maintain either the maximum number

of photon counts NMAX or a different maximum number of photon counts N'MAX over the range R2 (Fig. 3a and pg. 343 second column – pg. 344 first column).

As per independent claim 12, Bethune teaches a method of auto-calibrating a single-photon detector in a quantum key distribution (QKD) system having a controller (pg. 340 and Fig. 1), comprising:

sending weak photon pulses between encoding stations in the QKD system (Fig. 1);

performing a first detector gate scan to determine an optimum arrival time of a detector gate pulse sent from a controller to the detector; terminating the first detector gate scan (top part of Fig. 3a); and

periodically performing a first detector gate dither to maintain a maximum number of photon counts from the detector (bottom part of Fig. 3a, phase differences and pg. 343 second column).

As per dependent claim 12, Bethune teaches terminating the first detector gate dither; and performing a second detector gate scan ((Fig. 3a, and pg. 343).

As per claim 13, Bethune teaches A method of performing photon detector auto-calibration in quantum key distribution (QKD) system having a single-photon detector coupled to a controller (Fig. 1), the method comprising:

performing a detector gate scan to establish an optimum arrival time of a detector gate pulse that corresponds with a maximum number of photon counts from a single-photon detector in the QKD system (Fig. 3a);

terminating the detector gate scan [multiple delay tests] (Fig. 3a and pg. 343);

and performing a detector gate dither process by varying the arrival time of the detector gate pulse around the optimal value of the arrival time in order to provide minor adjustments to the arrival time to ensure that-the detector produces a maximum number of photon counts (pgs. 343-344).

Conclusion

The following prior art has been found pertinent to the invention but has not been relied upon in the claim rejections.

USP **6,342,701**, to Kash teaches A method of auto-calibrating a quantum key distribution (QKD) system having two encoding stations, a laser and a single-photon detector (SPD) unit (Fig. 2), comprising:
a) performing a laser gate scan by sending a laser gating signal to the laser and varying an arrival time T of the laser gating signal over a first select range R1 to determine an optimal arrival time TMAX that corresponds to an a first optimum number of photon counts from the SPD unit for photon signals generated by the laser and exchanged between the two encoding stations (Fig. 3).

USP **6,104,986** to Arevalo teaches a method directed to any algorithm whereby the phase can be shifted ever so slightly to achieve a gain in performance. Once a range is determined, that range can be further divided to test for the best value in the range because changing the phase yields different results (Fig. 4 and col. 5, lines 44-55).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL R. VAUGHAN whose telephone number is (571)270-7316. The examiner can normally be reached on Monday - Thursday, 7:30am - 5:00pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kim Vu can be reached on 571-272-3859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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2431
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